

At the annual meeting of the Incorporated Association of Headmasters of Secondary Schools, held on January 8, two resolutions were passed with regard to science teaching, which it is to be hoped may bear fruit in the form of an improved method in many of our schools. At the previous annual meeting a discussion had taken place on the subject; and as a result of this a memorial was sent, in July of last year, to the authorities controlling the Local examinations of Oxford and Cambridge Universities, setting forth the desire that "examining bodies should encourage a more rational method of teaching science" by framing the syllabuses on different lines. A committee was also appointed to consider the subject, and this committee, consisting of men possessed of considerable experience in science teaching in secondary schools, has now presented its report. They agree with all scientific educationists in saying that a large proportion of the time given to science in schools should be occupied by the pupils in performing actual measurements themselves, and that the object should be to impart not only information but chiefly the knowledge of method, and with this object in view, that the instruction should be given in strictly logical order. To serve as a basis of discussion with the University authorities, the committee has put forth an admirable syllabus, which includes the more fundamental portions of physics and chemistry, and (an important point) which indicates what experiments can easily be performed by beginners. The syllabus represents a practical scheme of elementary science which will be appreciated by teachers, and which cannot be too widely adopted. It indicates the manner in which the study of science in schools may be made of true educational value, and in the interests of science it is to be hoped that examining bodies will give it full consideration. Examinations at present dominate our educational system, and it is almost hopeless to attempt to introduce into schools a scheme of instruction that does follow the lines laid down by examiners. But if a syllabus is rational, the teaching which follows it will possess good features. If, therefore, the logical syllabus drawn up by the Committee of the Headmasters' Association be adopted by the Delegacy for Local examinations of Oxford and Cambridge, an important step will have been taken in the advance of scientific education in this country.

SCIENTIFIC SERIALS.

American Journal of Science, December 1895.—How to find the key-note of auditoriums, by E. Cutter. If a speaker uses the key-note of his auditorium, the audience shows by attitude and attention that it hears what is said. The speaker speaks with ease, and feels his voice impinge upon the farthest walls. The key-note may be found by means of a siren, or by singing, and observing which note resounds most powerfully. The paper contains practical hints of some value to public speakers, but is unscientific in tone and substance.—Stratigraphy of the Kansas coal-measures, by Erasmus Haworth. The different formations lie one above the other in regular order, similar to the order found in other parts of the world. The general character of the shales throughout the whole of the coal-measures is such that they must have been deposited, in the main, in shallow water, probably ocean-water, as evidenced by the frequency of ripple-marks and other physical properties. The coastal area must have progressed westward as geological time advanced. The thickness of the Kansas coal-measures cannot be much less than 2500 feet.—Igneous rocks of Yogo Peak, Montana, by W. H. Weed and L. V. Pirsson. Yogo Peak is composed of a core or stock of massive, granular, igneous rock, composed chiefly of augite and orthoclase. The mass shows a progressive differentiation along its east and west axis, with a continual increase in the ferromagnesian elements over the felspathic ones.—A new alkali mineral, by Warren M. Foote. This mineral, named Northupite, after its discoverer, crystallises in regular octahedra, whose diameters rarely reach 1 centimetre. It is brittle, shows uneven fracture, and a hardness of 3·5 to 4. In powdering the mineral a foetid odour is distinctly perceptible. It is easily fusible before the blowpipe, and its analysis indicates it to be a double chloride and carbonate of sodium and magnesium, with traces of phosphoric acid, silica, iron, calcium, and organic matter. It was found in the neighbourhood of the Borax Lake, California.—On the affinities and classification of the Dinosaurian reptiles, by O. C. Marsh. Twelve restorations of Dinosaurs are given, and a relation is traced between them and the Crocodilians.

NO. 1368, VOL. 53]

Wiedemann's Annalen der Physik und Chemie, No. 12.—On the origin of frictional electricity, by C. Christiansen. Differences of potential created by contact between two metals were investigated by means of "drop electrodes," one terminal of the electrometer being connected with the upper reservoir of mercury, and the other with the lower, in which plates of a different metal were immersed. The gas through which the drops fall is of considerable influence. Platinum becomes more positive in hydrogen, and more negative in oxygen. Other metals become more negative in hydrogen.—Dielectric constants of mixtures and solutions, by Ludwig Silberstein. Given two perfect insulators, like benzol and phenylethylacetate, which mix in all proportions and do not contract in the process, the specific inductive capacity of the mixture may be found by taking the sum of the products of the two separate volumes into their specific inductive capacities and dividing by the total volume. This proposition was experimentally proved by Nernst's method, with induction coil and telephone.—On the passage of electricity through gases, by A. Paalzou and F. Neesen. This is the continuation of a highly-interesting paper on various obscure phenomena connected with discharge tubes. The medium in which the discharge tubes were immersed had a decided influence upon them. Immersion in water or alcohol extinguished the glow. This was not due to condensation, since the total current was diminished, and extinction took some time to set in. Electrification of the outer surface of the tube, or discharge of it by a flame or other means, or the approach of a charged piece of sealing-wax—in short, any motion of electricity in the neighbourhood, favoured the internal discharge.—Movable light phenomena in rarefied gases, caused by electric oscillations, by J. Ebster and H. Geitel. In a discharge tube surrounded by a conducting ring put to earth, and touching another conductor connected with a strong induction coil, a pencil of bluish light is formed at a vacuum of 0·01 to 0·001 mm. of mercury, ending in an intense green phosphorescent patch next the conductor, tapering as it passes through the ring, and ending somewhere in the gas space. The approach of a conductor or a magnet makes the pencil assume various shapes and positions.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 21, 1895.—"On the Variable Stars of the δ Cephei Class." By J. Norman Lockyer, C.B., F.R.S.

Prof. E. C. Pickering, in his classification of the variable stars, which is based on a study of the light curves (*Amer. Acad. Proc.*, vol. xvi. p. 17), recognises two classes of variables having short periods. His Class IV. includes those variables, exemplified by δ Cephei and β Lyrae, in which the light changes are not of very great range, and continue throughout the period. Class V. comprises those like Algol in which there is a temporary reduction of light at minimum, produced by the eclipse of the bright star by a relatively dark companion; this explanation has since been established by spectroscopic investigations, which have shown that there is no change in the spectrum at minimum, and that there is an orbital movement of corresponding period.

Excluding β Lyrae, which, as shown in the paper, is spectroscopically different from the others so far examined, it will be convenient to refer to the remaining variables of Pickering's Class IV. as those of the δ Cephei class, and it is with some of these that the present paper is concerned.

The available spectroscopic data with regard to the δ Cephei class were very meagre, and I therefore determined to investigate the spectra photographically, so far as the means at my disposal would permit. Five stars were studied, namely, η Aquilæ, ζ Geminorum, δ Cephei, τ Vulpeculæ, and S Sagittæ.

Five very definite results have been arrived at:—

- (1) The spectra of the five variables of this class which have been photographed are practically identical.
- (2) The five variables in question are stars of increasing temperature.
- (3) There is a general weakening of the continuous spectrum as the light of the star decreases.
- (4) There are no indications of bright-line radiation at the positions occupied by the lines of hydrogen or helium at any part of the period in the case of these variables.
- (5) There is no visible doubling of the lines in any of the photographs.

A portion of the spectrum of δ Cephei, at the time of maximum, is compared with the spectra of γ Cygni and Arcturus in the accompanying diagram. These have been enlarged about ten times from the original negatives taken at Kensington.

Taking Arcturus as a representative star of the solar type (*Phil. Trans.*, 1893, vol. 184, A, p. 699), it will be seen that although the spectra of γ Cygni and δ Cephei resemble it in showing a large number of dark lines, they differ considerably from it in point of detail.

Since the greater part of the foregoing was written, the results of a photographic study of the spectrum of δ Cephei, with special reference to its movement in the line of sight, have been published by Belopolsky (*Imp. Acad. Sc., St. Petersburg Bull.*, November 1894). Belopolsky differs from me in classing the

report upon the species. It contained 162 specimens, almost all of which were collected in the Indian Seas, from the Persian Gulf to the coast of Australia, during the cruise of H.M.S. *Investigator*. Fifteen genera were represented, and several new species were described belonging to the genera *Chairotenthis*, *Histiopsis*, *Abralia*, *Loliolus* and *Faonius*. The paper was illustrated by original drawings.

PARIS.

Academy of Sciences, January 6.—M. A. Cornu in the chair.—M. Chatin was elected Vice-President for 1896.—The retiring President (M. Marey) announced to the Academy how the vacancies arising in 1895 amongst the members and corresponding members had been filled up.—Note on the

42

43

44

1. δ CEPHEI2. γ CYGNI

3. ARCTURUS

star as a solar one, although he draws attention to numerous differences between the spectrum of the star and that of the sun.

He also finds, as I have found, that there is probably no change of spectrum corresponding to the light changes, except a general change of intensity.

Linnean Society, December 19, 1895.—Mr. W. P. Sladen, Vice-President, in the chair.—Mr. William Scott was elected, and the Rev. T. R. Stebbing, Rev. H. P. Fitzgerald, and Mr. A. W. Geffcken were admitted Fellows of the Society.—Mr. W. B. Hemsley exhibited specimens and photographs of *Cactæ* from the Galapagos Islands, and gave an account of some of the more remarkable species.—Mr. George Brebner exhibited and described, with the aid of microscope and lantern slides, several new and rare Alge.—Mr. J. E. Harting exhibited a living specimen of the Snow Bunting (*Emberiza nivalis*), which had been captured, with several others, off Cape Race on board the s.s. *Ottoman* in October last, during the voyage from Boston to Liverpool, as mentioned at a former meeting (November 7).—Mr. R. A. Rolfe gave an abstract of a paper entitled "A Revision of the Genus *Vanilla*," in which some fifty species were enumerated, seventeen of which were new, though five of them had been previously confused with older forms. The plants in this genus were described as tall forest climbers, some of them leafless, found almost throughout the tropics, though generally somewhat local in their distribution. Of the species described, 29 were American, 11 Asiatic, and 10 African.—Mr. E. S. Goodrich communicated a report on the collection of Cephalopoda in the Calcutta Museum. He explained that this collection had been forwarded from Calcutta to Prof. Ray Lankester, at whose request he had undertaken to examine and

works of Mr. John Russell Hind, late correspondent of the Astronomical Section, by M. F. Tisserand.—An aneurism of the neck, face, and mouth treated by the sclerogenous method, by M. Lannelongue. An account of the successful treatment of a widespread aneurism by injections of zinc chloride solution (10 per cent.).—On the Calendar, by M. Flamant. A criticism of an alteration of the Gregorian rule for finding leap-year, suggested by M. Auric. The alternative proposed by the author, not to consider as leap-years the dates $(32)^n \times 100$, that is, 3200, 6400, &c., has the advantage of postponing any departure from the Gregorian rule for 1200 years. The length of the mean solar year deduced from this is only two-millionths of a mean solar day in excess of the truth.—On integral invariants, by M. G. Kœnigs.—On a method of splitting up some definite integrals into simple elements, by M. M. Petrovitch.—On the absolute values of the magnetic elements on January 1, 1895, by M. T. Moureaux. The absolute values and secular variation during 1895 of declination, inclination, horizontal and vertical intensity, and total force are given for the two observatories of Parc Saint-Maur and Perpignan.—The action of nitrogen peroxide on the halogen salts of tin, by M. V. Thomas. The reaction was studied in chloroform solution. Tin tetrachloride gave a crystalline substance of the empirical composition $\text{Sn}_4\text{Cl}_{14}\text{N}_2\text{O}_6$. This is hygroscopic, and is decomposed on heating. Tin tetrabromide gave $\text{Sn}_4\text{Br}_6\text{N}_2\text{O}_{10}$ as a white powder. The product obtained from the tetraiodide contained no iodine, and had the composition $\text{Sn}_5\text{O}_{11}(\text{NO}_3)_2 + 5\text{H}_2\text{O}$.—On a mode of decomposition of some amides and amido-compounds, by M. Echsner de Coninck. An account of the results obtained on treating some aromatic amides and amido-

derivatives with an alkaline solution of sodium hypochlorite. —The rôle of the fever in the evolution of an infectious disease, by M. Cheinisse. —On serotherapy of tuberculosis, by MM. V. Babes and G. Proca. In the case of the animals used, chiefly dogs, immunity to virulent tuberculous injections was effected by treatment with tuberculin in increasing doses for several months, followed by subcutaneous injection in increasing doses of the dead bacilli that had already served for the preparation of the tuberculin. —On the embryonic membranes of the *Molgula*, by M. A. Pizon. —On the gills of the *Tetracilla porosa*, by M. A. Gruvel. The oxygenising surface of the gills is enlarged in a peculiar manner; instead of only one lamella, there are from eight to ten, of different sizes, according as they are at the ends or the middle of the gill, each of which is folded on itself in the most irregular fashion. —Note on *Mucor* and *Trichoderma*, by M. J. Ray. A description of a new species of *mucor*, to which the name of *Mucor crustaceus* is given, and of a parasite much resembling *Trichoderma viride*. This case of parasitism is accompanied by important modifications, both of the host and of the parasite: in the former, the mineral coating being largely increased, and its spores reduced in number; in the latter, appearance of a continuous structure, and reduction of the fructiferous apparatus. —On the yield of flour from wheat, and on whole-meal bread, by M. Balland. —On some French lakes, by M. A. Delebecque. —On the abyss of Gaping Ghyll, by M. E. A. Martel.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, JANUARY 16.

ROYAL SOCIETY, at 4.30. —The Rotation of an Elastic Spheroid: S. S. Hough. —On a Type of Spherical Harmonics of Unrestricted Degree, Order, and Argument: Dr. Hobson, F.R.S. —Memoir on the Theory of the Partitions of Numbers. Part I.: Major MacMahon, F.R.S. —Some Physical Properties of Argon and Helium: Lord Rayleigh, Sec.R.S. LONDON INSTITUTION, at 6. —Experiments with Incandescent Lamps: Prof. Fleming, F.R.S. LINNEAN SOCIETY, at 8. —On the Fistulose Polymorphinæ and the Ramulinæ: Prof. T. Rupert Jones, F.R.S., and F. Chapman. SOCIETY OF ARTS, at 4.30. —The Shan Hills: their Peoples and Products: Colonel R. G. Woodthorpe, C.B., R.E. SOCIETY OF ANTIQUARIES, at 8.30. CHEMICAL SOCIETY, at 8. —The Acetylene Theory of the Luminosity of Hydrocarbon Flames: Prof. Vivian B. Lewes. —And other Papers. INSTITUTION OF ELECTRICAL ENGINEERS, at 8. —Presentation of Premiums. —Inaugural Address of the President, Dr. John Hopkinson, F.R.S. NUMISMATIC SOCIETY, at 7.

FRIDAY, JANUARY 17.

ROYAL INSTITUTION, at 9. —More about Argon: Lord Rayleigh, Sec.R.S. QUEKETT MICROSCOPICAL CLUB, at 8. INSTITUTION OF CIVIL ENGINEERS, at 8. —Iron Tunnels: W. O. Leitch. EPIDEMIOLOGICAL SOCIETY, at 8. —Experiences in Relation to Cholera in India from 1842-79: Surgeon-General C. A. Gordon, C.B.

SATURDAY, JANUARY 18.

ROYAL INSTITUTION, at 3. —To the North of Lake Rudolf and among the Gallas: Dr. A. Donaldson Smith.

MONDAY, JANUARY 20.

SOCIETY OF ARTS, at 8. —Alternate Current Transformers: Dr. J. A. Fleming, F.R.S. VICTORIA INSTITUTE, at 4.30. —On Newly-deciphered Inscriptions: Mr. Pinches.

LONDON INSTITUTION, at 5. —Cambridge University; its History and Development: E. J. C. Morton, M.P.

TUESDAY, JANUARY 21.

ROYAL INSTITUTION, at 3. —The External Covering of Plants and Animals: Prof. C. Stewart.

ROYAL PHOTOGRAPHIC SOCIETY, at 8. —On Irregular Grained Screens: E. Sanger Shepherd.

INSTITUTION OF CIVIL ENGINEERS, at 8. —The Sanitary Works of Buenos Ayres: Sewerage, Drainage, and Water-Supply: Hon. R. C. Parsons.

ANTHROPOLOGICAL INSTITUTE, at 8.30. —Annual Meeting.

ROYAL STATISTICAL SOCIETY, at 5.

WEDNESDAY, JANUARY 22.

SOCIETY OF ARTS, at 8. —Supply of Sea-Water to London: Frank W. Grierson.

GEOLOGICAL SOCIETY, at 8. —On the Speeton Series in Yorkshire and Lincolnshire: G. W. Lamplugh. —On Cretaceous Podophthalma from Vancouver and Queen Charlotte Islands: Dr. Henry Woodward, F.R.S. —On a Fossil Octopus from the Cretaceous of the Lebanon: Dr. Henry Woodward, F.R.S. —On Transported Boulder Clay: Rev. Edwin Hill.

THURSDAY, JANUARY 23.

ROYAL SOCIETY, at 4.30.

CHEMICAL SOCIETY, at 8. —Helmholtz Memorial Lecture: Prof. G. F. Fitzgerald, F.R.S.

LONDON INSTITUTION, at 6. —Unexplored Glaciers of Vatna Jökul: F. W. W. Howell.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

SOCIETY OF ANTIQUARIES, at 8.30.

FRIDAY, JANUARY 24.

ROYAL INSTITUTION, at 9. —Ludwig and Vitalism: Prof. Burdon Sanderson, F.R.S.

PHYSICAL SOCIETY, at 5. —Exhibition of some Geometrical Instruments; E. Scott and Signor Monticelo. —On Resonant Tones: Prof. J. D. Everett, F.R.S. —Experiments with Incandescent Lamps: Sir D. Salomons.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS. —Object Lessons for Infants: V. T. Murché, Vol. 2 (Macmillan). —Ethnology: A. H. Keane (Cambridge University Press). —Popular Telescope Astronomy: A. Fowler (Phillip). —Journal of Microscopy and Natural Science, third series, Vol. 5 (Baillière). —The Steam Engine: Prof. J. H. Cotterill, 3rd edition (Spon). —Folk og Natur i Finnmarken: H. Reusch (Kristiania, Brogger). —A New View of the Origin of Dalton's Atomic Theory: H. E. Roscoe and A. Harden (Macmillan). —Types of American Character: G. Bradford (Macmillan). —Wissenschaftliche Abhandlungen der Physikalisch-Technischen Reichsanstalt, Band ii. (Berlin, Springer). —Beobachtungen der Russischen Polar Station an der Lenamündung, 1 Theil, 1882-84. —Nouveaux Mémoires de la Société Helvétique des Sciences Naturelles, Band xxxiv. (Williams). —The Koh-i-Nûr Diamond: E. W. Streeter (Bell). —Ostwald's Klassiker der Exakten Wissenschaften, Nr. 67 to 71 (Leipzig, Engelmann). —The Life and Letters of George John Romanes (Longmans). —Discoveries and Inventions of the Nineteenth Century: R. Routledge, 11th edition (Routledge).

PAMPHLETS. —Some Factors in the Evolution of Adaptations: G. D. Haviland (Porter). —La Théorie Atomique et la Théorie Dualistique: Prof. E. Lenoble (Paris, Gauthier-Villars). —Government and Religion of the Virginia Indians: Dr. S. R. Hendren (Baltimore).

SERIALS. —Engineering Magazine, January (Tucker). —American Journal of Science, January (New Haven). —Journal of Anatomy and Physiology, January (Griffin). —Verhandlungen der Naturhistorischen Vereins der Preussischen Rheinlande, &c., 52 Jahrg. 1. Hälfte (Bonn). —Psychologische Arbeiten, Erster Band, 2 and 3 Heft (Leipzig, Engelmann). —Strand Magazine, January (Newnes). —Strand Musical Magazine, January (Newnes). —American Naturalist, January (Philadelphia). —Journal of the Chemical Society, January (Gurney). —Himmel und Erde, January (Berlin). —Berichte der Naturforschenden Gesellschaft zu Freiburg i.B., June, September, 1894; September 1895 (Williams). —Morphologisches Jahrbuch, 23 Band, 3 and 4 Heft (Williams). —Zeitschrift für Wissenschaftliche Zoologie, ix. Band, 4 Heft; Ditto, lxi. Band, 1 Heft (Williams).

CONTENTS.

PAGE

Euclid and his Editors. By G. B. M. 241
Recent History of the Carbohydrates 242
Our Book Shelf:—

Turpin: "Practical Inorganic Chemistry" 243
Pinar: "Observaciones de precision con el Sextante" 244
Rosenberg: "First Stage Mechanics" 244
Chambers: "The Story of the Solar System" 244
"British Guiana and its Resources" 244
Bell: "Mammals of Land and Sea" 244

Letters to the Editor:—

A New Method of Measuring Temperature.—
Prof. Reginald A. Fessenden 244
On Crookes' Spectrum of Helium.—C. Runge and
F. Paschen 245
The Place of "Pithecanthropus" in the Genealogical
Tree. (With Diagram.)—Dr. Eug. Dubois 245
An Anagram.—E. H. 247
The Barisal Guns and Similar Sounds.—Lieut.-
Colonel H. H. Godwin-Austen, F.R.S.; T. D.
La Touche 247
Boring a Coral Reef.—W. W. Watts 248
Variability of Red Stars.—Dr. A. Brester; The
Writer of the Note 249
Mount Wosho.—Antoine d'Abbadie; The Writer
of the Note 248
Cactaceæ in the Galapagos.—W. Botting Hemsley,
F.R.S. 249
A Luminous Centipede.—T. Plowman 249
The Critical Temperature of Hydrogen.—Dr. L.
Natanson 249
A Fog Scale.—Alfred O. Walker 249

Fluorescence of Sodium and Potassium Vapours,
and the Importance of these Facts in Astro-
physics. (With Diagrams.) By Drs. E. Wiedemann
and G. C. Schmidt 250

Notes

Our Astronomical Column:—
Hind's Variable Nebula 255
o Ceti 255
Stellar Velocities with Objective Prism 255

A New Star in Centaurus

The Ethnology of the British Upper Classes. By
R. J. Horton-Smith 256

The Smithsonian Institution. I. (Illustrated.) By
Dr. G. Brown Goode 257

University and Educational Intelligence 261

Scientific Serials 262

Societies and Academies. (Illustrated.) 262

Diary of Societies 264

Books, Pamphlets, and Serials Received 264